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(दूसरा पुनरीक्षण)

Indian Standard

LIQUEFIED PETROLEUM GAS STORAGE INSTALLATIONS — CODE OF PRACTICE

PART 1 RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CYLINDER INSTALLATIONS

(Second Revision)

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B U R E A U O F I N D I A N S T A N D A R D S
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NEW DELHI 110002

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Gas Cylinders Sectional Committee, MED 16

FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1971 and subsequently revised in 2000. In this revision scope has been enlarged to include the liquid withdrawal from the cylinder. New clauses for point of delivery, maintenance and handling and use have been added.

Cylinder location, cylinder manifolds, pressure regulators and piping, tubes and fittings have been modified. A new Annex A has been added to include requirements of liquid off take valve multi cylinder installation.

While implementing this standard, compliance with statutory regulations shall be ensured.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1 SCOPE

1.1 This standard (Part 1) lays down the code of practice for the installations of LPG cylinders for vapour withdrawal from cylinders, the associated piping and equipment in commercial and industrial premises and for liquid withdrawal from cylinders, piping and equipment in industrial premises.

1.2 This Code applies to installations in commercial, industrial, educational, institutional premises and domestic/residential complexes installations including wherever, cylinder manifold is provided. The installation for Liquid withdrawal shall be provided only in industrial premises. The specific requirements for installation of Liquid withdrawal from cylinders are covered in Annex A.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No.	*Title*
383 : 1970	Specification for coarse and fine aggregates from natural sources for concrete (*second revision*)
1239 (Part 1) : 2004	Steel tubes, tubulars and other wrought steel fittings — Specification: Part 1 Steel tubes (*sixth revision*)
2171 : 1999	Portable fire extinguishers, dry powder (cartridge type) (*fourth revision*)
2379 : 1990	Colour code for identification of pipe lines (*first revision*)
2501 : 1995	Solid drum — Copper tubes for general engineering purposes (*third revision*)
2878 : 2004	Fire extinguisher, carbon dioxide type portable and trolley mounted (*third revision*)
3043 : 1987	Code of practice for earthing (*first revision*)
3601 : 2006	Steel tubes for mechanical and general engineering purposes (*second revision*)
4576 : 1999	Liquefied petroleum gases — Specification (*second revision*)
6044 (Part 2) : 2001	Code of practice for liquefied petroleum gas storage installations: Part 2 Commercial, industrial and domestic bulk storage installations (*first revision*)
7241 : 1981	Glossary of terms used in gas cylinder technology (*first revision*)
9573 : 1998	Rubber hose for liquefied petroleum gas (LPG) — Specification (*second revision*)
13849 : 1993	Specification for portable fire extinguisher dry powder type (constant pressure)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7241 and the following shall apply.

3.1 Installation — A designated premises in an establishment where the complete multi cylinder system comprising of cylinder, piping manifold, vapourisers, etc, is installed.

3.2 Manifold — A pipe header provided with several opening to which the cylinders are connected by using suitable pipe fittings.

3.3 Distribution/Distributing Company — The company which is in the field of marketing LPG and is the owner of cylinders.

3.4 Competent Authority — The Authority designated or otherwise recognized under *Gas Cylinder Rules*, 2004 for approving LPG cylinders, valves and regulators.

3.5 Approved Agency — Person or agency or a corporate body approved by competent authority or distribution company to execute the job of designing, erection and maintenance of multi cylinder installation.

4 GENERAL RECOMMENDATIONS

4.1 The system shall be installed by an approved agency. The approved agency shall have trained manpower that is well versed with the characteristics of LPG and is trained in good practice of handling, installing and maintaining installations.

4.2 The system shall be installed in line with the specifications and requirements stated in this standard and shall conform to the approved layout (approved by the distributing company or by local authorities wherever applicable).

4.3 The maintenance, inspection, repair, etc, of the system shall be done by agencies approved by the LP gas distribution company or by the LP gas distributing company themselves.

4.4 Cylinders and cylinder valves shall comply with the relevant standard and shall be approved by the statutory authorities. All other equipment such as pressure regulators and other installation material shall comply with the statutory provisions or relevant Indian Standards. In the absence of any such provisions or Indian Standards, equivalent international norms shall be followed. For LPG lines, threaded joints shall not be provided except for special fittings like excess flow check valve, TRV, pressure gauges.

4.5 Point of Delivery

Location of cylinder bank and point of delivery of LPG cylinders shall be acceptable to the Distributing Company. Proper motorable approach to the point of delivery/Bulk LPG storage installation shall be provided for ease in delivery/receipt of filled/empty cylinders through vehicles. The approach is also required to provide free access to fire tender and fire fighting personnel in case of any emergency.

The access route to the point of delivery must be firm and compact even in wet conditions and adequate space must be provided for parking of cylinder truck making delivery of cylinders.

4.6 The colour coding of LPG liquid and vapour lines shall be as per IS 2379. The colour coding shall be clearly stated on an instruction board provided in the shed and also at the main office. The direction of flow shall be indicated on the pipeline with a black colour paint.

4.7 Fire extinguishers of powder type (*see* IS 2171) or carbon-dioxide (*see* IS 2878) type or stored pressure Type A, B, C (*see* IS 13849) shall be provided in places where LPG cylinder installations are situated and shall be located near such installations. Two buckets filled with sand and two with water shall also be installed nearby. The number, type and size of the fire extinguishers shall be as follows:

Sl No.	*LPG Installations*	*Number*	*Type*	*Capacity* kg
a)	For installations with LPG 40 to 200 kg	2	Dry powder	10
b)	For installations with LPG more than 200 and up to 320 kg	3	Dry powder	10
c)	For installations with LPG more than 320 and up to 1 000 kg	4	Dry powder	10

NOTE — For electrical installation 1 No. CO_2 (4.5 kg capacity) fire extinguisher shall be provided.

4.8 Safety cap shall be put on all cylinders not in use, whether empty or filled with gas. Storage of filled cylinders shall be as per statutory requirement.

4.9 The storage room shall have caution signs such as 'DANGER', 'HIGHLY INFLAMMABLE GAS SHED', 'NO SMOKING', etc, painted in luminous red paint, outside at a prominent place.

5 CYLINDER LOCATION

5.1 Stationary Installations

5.1.1 Stationary installation not exceeding 50 kg of LPG may be installed indoors on any floor. It is recommended to have a minimum floor area of 5m^2 for such an installation.

5.1.2 Stationary installations each not exceeding 50 kg of LPG may be installed indoors on any floor and within the same workspace provided the minimum distance between two such installations is 3 m, the proportion of such installations to floor area is one installation per 5 m^2 and the aggregate quantity of gas of all such installations does not exceed 200 kg.

5.1.3 Stationary installation not exceeding 100 kg of LPG may be installed indoors on any floor provided the floor area for such an installation is not less than 12 m^2.

5.1.4 Stationary installations each not exceeding 100 kg of LPG may be installed indoors on any floor and within the same workspace provided the minimum distance between two such installations is 3 m, the proportion of such installations to floor area is one installation per 12 m^2 and the aggregate quantity of gas of all such installations does not exceed 200 kg.

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5.1.5 Stationary installation not exceeding 400 kg of LPG may be installed indoors in an enclosed section of a building or a room reserved exclusively for this purpose and ventilated at low level directly to the outside air.

5.1.6 Stationary installations above 400 kg (200 kg in case provision as in **5.1.5** is not possible) but not exceeding 1 000 kg shall be installed outdoors on ground floor level only. A minimum distance of 3 m shall be maintained between an installation and any building, public place, roadways, and other surroundings. The installation shall be protected from excessive weathering by sun, rain, etc and from tampering by unauthorized persons. A lean-to roof with expanded metal on angle-iron framework on the sides is considered suitable for this purpose. In any case, adequate ventilation at ground level to the outside air shall be provided.

5.1.7 If the storage per installation is more than 1 000 kg, installations in multiples of 1 000 kg with manifold, safety devices, change over mechanism may be provided with minimum inter distance of 3 m from all sides. Total number of such installations shall not exceed 4 including stand by installation. If more than two installations are used, then number of cylinders per installations should not exceed 30.

5.1.8 For storage installations of 1 000 kg or installations in multiple of 1 000 kg the number of cylinders to be connected per manifold shall not exceed 15 and for each 1 000 kg installation two such manifolds shall be provided.

5.1.9 Cylinders shall be installed upright with the valves uppermost.

5.1.10 Cylinder containing more than 20 kg of gas shall not be located on floors above ground level.

5.1.11 Cylinders shall be located on a concrete or brick floor, preferably raised in case of outdoor installations.

5.1.12 In order to prevent the hazardous collection of gas, cylinders shall be placed at least 1 m away from culverts, depressions, or openings leading to below ground level compartment and drains.

5.1.13 Cylinders which have safety relief valves or similar devices incorporated in them shall be so positioned so that if the relief device operates, escaping gas is not hazardous.

5.1.14 Cylinder installation for commercial/industrial/domestic/residential complexes, etc, or at any public place shall meet the following requirements:

a) For commercial and industrial cylinder installation for any public places like mall, buildings, industries, hotels, etc, the sum total of all stationery installations inside the building shall not exceed 400 kg of LPG in any case. In case sum total of net weight of all the cylinders installed indoors exceed 400 kg provision for outdoor installations shall be made. For installations where the sum total is less than 400 kg of LPG provisions of **5.1.2** to **5.1.5** shall apply.

b) For commercial and industrial cylinder installation for any public place, industry, etc, if the net weight of all the cylinders installed is more than 400 kg but less than 1 000 kg, than the installation shall be provided outdoors in line with **5.1.6**. The cylinder installation shall be provided in a covered industrial shed but open from all sides for proper ventilation. In case the installed capacity increases more than 1 000 kg, than the installation shall be provided in line with **5.1.7**. Two separate installations shall be provided and distance between each of the installations shall be minimum 3 m (this distance shall be between the outer edge of the two sheds).

c) For multi-storied buildings, flats housing society the reticulated installation of any capacity shall be provided at a safe place especially earmarked for this purpose. The installation shall not be provided by the side of road where there is continuous movement of vehicles or is approachable to residents especially children. The installation should be secured and should be provided in a covered shed open from all sides for ventilation. The area shall be demarcated by 1.5 m high chain link fencing having one gate. There should be minimum 3 m clear space all around the fencing and the space between the fencing and the edge of the shed should be minimum 2 m all around.

d) If the requirement is more than 1 000 kg, installations in multiples of 1 000 kg with manifold, safety devices, change over mechanism, not exceeding 4 such installations (including stand by) may be provided with minimum distance of 3 m from all sides. The number of cylinders per installations should not exceed 30.

e) *Location of cylinder bank*:

1) The site for LPG cylinder manifold shall be located away from the kitchen/LPG utility area/residential building. Installation shall be slightly raised minimum 100 mm from surrounding ground level.

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2) Cylinders installation should not be located in inaccessible location, under a stairway, basements, cellars, where air movement across cylinders is very low/ not present, to prevent the cylinders from getting inadequate latent heat and un-approachable during emergency.

3) Cylinders installation should not be close to steam pipes, boilers, transformers, DG sets, etc, to prevent cylinders from getting affected due to radiant heat.

4) Cylinders shall not be installed at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety.

5) Cylinders installation should not be located along the drive way. Under unavoidable conditions, minimum distance of 3 m from drive way shall be maintained. Brick masonry (minimum 230 mm thick)/concrete (minimum 100 mm thick) walls or metallic Shields/ barriers (minimum 1.63 mm sheet) and of minimum 2 m height should be erected between drive way and cylinder installation for the safety and security of the installation.

6) Cylinders shall be located on a concrete or brick floor that is firm, at level, smooth, drained in case of outdoor installation.

7) The cylinder shall be installed in upright position with the valve pointing upwards and minimum 1 m away from any combustible materials.

5.1.15 *Cylinder Storage Room*

a) The cylinder storage room shall be made out of non flammable material that is concrete (minimum 100 mm thick) or brick masonry walls (minimum 230 mm thick) or steel structures made out of minimum 5 mm thick MS angle iron structure and 1.63 mm MS wire mesh of size minimum 11.

b) Since LPG is heavier than air, ventilation shall be provided at floor level, that is 100 mm above inside cylinder bank room, open to atmosphere. The ventilators shall be provided with 2 layers copper or non-corroding metal wire mesh not less than 11 to the linear centimeter. The size of the ventilators should be minimum 500 mm long and 300 mm height.

c) The storage room shall be well ventilated, that is openings/ventilators shall be provided in the walls of cylinder storage covering minimum 25 percent of wall area. It should also have adequate lighting. Both exteriors and interiors should be painted with weather proof paints. FLP fittings, approved by statutory authorities shall be provided for electrical use.

d) The doors of the room where cylinders are installed shall open outwards and shall have louvers/wire mesh to ensure visibility and ventilation.

e) Flammable materials like wood and plastic shall not be used. The cylinder bank storage room shall not used for storing any other materials.

5.2 Portable Installations

When portability of cylinders is necessary, the following requirements shall be fulfilled:

a) The sum total of capacity of the cylinders connected to each manifold shall not exceed 100 kg of LPG. The total quantity of gas thus installed in a workspace shall not exceed 200 kg.

b) If cylinders are mounted on a trolley, the trolley shall be stable. Where necessary, the cylinders shall be secured to prevent them from falling.

c) The regulator shall be connected directly to the cylinder valve or to a manifold which shall be connected to the cylinder valves by means of rigid connections to give adequate support to the regulator. The only exception to this requirement is where cylinders are mounted on a trolley and the manifold is rigidly supported on the trolley. In such a case flexible or semi-flexible connections may be used between the cylinder valves and the manifold but not between the manifold and the regulator.

d) Anytime the total quantity of gas at portable installations shall be in proportion to the floor area as specified in **5.1.1** to **5.1.7**.

e) At any time the provision at **5.1.1** to **5.1.15** shall be ensured for all installations.

5.3 Point of Delivery

Location of cylinder bank and point of delivery of LPG cylinders shall be acceptable to the distribution company. Proper road shall be provided for easy movement of trucks carrying cylinders. The approach is also required to provide free access to fire tender and fire fighting personnel in case of any emergency.

The access route to point of delivery must be firm and compact even in wet conditions and adequate space

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must be provided for parking of cylinder truck for making delivery of cylinders.

The distance from point of delivery to cylinder bank should not be more than 75 m and the path should firm and compact even in wet condition and min 600 mm wide for easy movement of cylinder trolley.

6 CYLINDER MANIFOLDS

6.1 All materials, fittings, etc, used in cylinder manifold systems shall comply with the statutory provisions or relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international norms shall be followed.

6.2 The individual component parts of manifolds, that is piping, fittings, pigtails, etc, which are subject to cylinder pressure shall be capable of withstanding a test pressure without bursting of 25 kgf/cm^2 or one and a half times the developed pressure at 65°C, whichever is more.

6.3 Where cylinder installations are made up with service and reserve batteries of cylinders, suitable change-over devices or valves shall be incorporated in the manifold header to prevent undue escape of the gas when cylinders are changed.

6.4 In case pressure regulators, manifold headers and automatic change-over devices are connected to cylinder by semi-flexible connectors, these shall be rigidly supported. Copper tube pigtails are considered to be semi-flexible for this purpose.

6.5 It is recommended that joints in manifold headers which do not have to be broken in normal use should be welded or brazed using a material which shall have a melting point of at least 540°C.

6.6 All joints between manifold headers and cylinder connectors shall be readily accessible.

6.7 All joints in the manifold should be welded (except for valve fixation) and be easily accessible for inspection/repairs, etc.

6.8 Each manifold arm shall be fabricated in such a way that minimum joints are provided. Only seamless pipes are recommended for use in manifolds. There should be a minimum gap of 300 mm between the manifold and valve protection ring of the LPG cylinders.

6.9 The cylinders connected to a manifold shall be safely spaced for easy and safe replacement of cylinder when empty. A minimum distance of 400 mm shall be maintained between two nipples provided on the manifold for connecting the cylinders to the manifold. In case the diameter of the cylinder is higher than 400 mm then the distance between the two nipples shall be diameter of the cylinder plus 100 mm.

6.10 A pressure gauge of 10 cm dial shall be provided in the manifold to indicate the gas pressure in the manifold. The pressure gauge shall be suitable for a pressure range 0 to 10 kgf/cm^2.

7 PRESSURE REGULATORS

7.1 Pressure regulators and other devices used to control the gas shall comply with the statutory provisions or relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international norms shall be followed.

7.2 If the regulator is fitted with a relief valve, care should be taken in positioning the regulator to avoid unnecessary hazards, if the relief valve functions.

7.3 Pressure regulators and other control devices shall be adequately supported.

7.4 The pressure regulators installed shall be accessible for servicing and they shall be protected against any physical damage.

7.5 Venting

An independent vent to the outside of the building sized in accordance with the manufacturer's instructions/oil company's guidelines will be provided where the location of a regulator is such that a ruptured diaphragm shall cause a hazard. Where more than one regulator is installed, then each regulator shall have separate vent to the outside. The vent shall be designed to prevent the entry of water, insects, or other foreign material that could block the passage. The height of the vent shall be 1.5 m above the eaves end of the shed or from the bottom of the roof.

The regulator shall not be vented to the gas equipment flue or exhaust system.

7.6 Parallel Regulators

Where uninterrupted supply is required two pressure regulator in parallel along with non-return valves, double isolation valves may be installed. Both regulators may be set at slightly different pressures so that one of the regulators shall act as a stand by.

7.7 Identification

When multiple regulators are installed in a building/ system, then they shall be marked by a metal tag or other permanent means designating the building or part of the building/gas utilizing equipment being supplied.

7.8 Over Protection Devices

Over pressure shut-off (OPSO) protection required to

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protect the downstream appliances from hazardous pressure or the failure of the regulator shall be provided.

7.9 Under Protection Devices

Under pressure shut-off (UPSO) protection shall be provided in regulator near gas utilizing appliances. This shall shut-off gas flow in case of low pressure in the down stream gas supply.

8 PIPING, TUBING AND FITTINGS (EXCLUDING MANIFOLDS)

8.1 All piping, tubing and fittings shall comply with the statutory provisions or relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international norms shall be followed.

8.2 Copper Tube

Solid drawn copper tubes of outside diameter 10, 12 or 20 mm, as suitable, conforming to IS 2501 shall be used. The minimum wall thickness of the tubes shall be 1 mm.

8.3 Steel Tubes

Cold drawn seamless, electric welded, cold drawn electric resistance welded (ERW), or oxyacetylene welded tubes of suitable sizes conforming to IS 3601 shall be used.

8.4 Mild Steel Tubes

Hot finished seamless, or electric resistance welded (ERW) mild steel tubes of suitable size, conforming to medium or heavy class of IS 1239 (Part 1) or any other steel tube approved by statutory authority shall be used.

8.5 The material used for flexible tubing and hose which are not subjected to full cylinder pressure shall be such that the tubing may withstand a test pressure without bursting of 3.5 kgf/cm^2 to 7 kgf/cm^2 or five times the maximum operating pressure to which it may be subjected in normal use, whichever is greater.

8.6 The material used for shut-off valves and similar equipment which are not subjected to fill cylinder pressure shall be such that they may withstand a test pressure of 14 kgf/cm^2 or one and a half times the maximum operating pressure to which they may be subjected in normal use, whichever is greater.

8.7 Cast iron and aluminium fittings shall not be used.

8.8 In the case of flange connections, the flanges shall be machined and should preferably have raised face. Metallic/spiral wound metallic gasket of minimum thickness or 1.5 mm is preferable to be used.

8.9 For any kind of movable appliance or burner, flexible connectors shall be used and they shall be of a type that resists abrasion.

8.9.1 Where the operating pressure of the appliance or burner exceeds 100 gmf/cm^2, both ends of the connectors shall be positively attached (for example, by suitable clips) to prevent them from coming off the hose nipples because of pressure or tension in the hoses.

8.10 Emergency Shut-Off Valve

A quarter turn emergency shut-off valve (ESOV) designed to work on LPG, shall only be used for mainline for shut-off operation. These are quick shut-off valves like ball/plug valves. They should be installed as close as practicable to the point where gas enters the premises to which adequate access shall be provided. If it is installed inside the building it should be close to the entry point.

In open position, the lever/key of the ESOV shall be in parallel to the axis of the pipeline on which it is installed. An emergency operating procedure is distinctly displayed near the ESOV.

8.11 Flanges

In case of flange connections, the flanges shall be machined and should preferably have raised face. For LPG lines subjected to full cylinder pressure of LPG liquid lines the minimum flange rating shall be 300 class rating.

8.12 Flange Gaskets

The acceptable materials for gaskets are metal or spiral wound metallic gaskets. Whenever flange connection is opened, gasket should be replaced. For liquid lines only spiral wound metallic gaskets shall be used.

8.13 Used Pipes, Fittings

Used pipe, fittings, valves or other materials shall not be used again unless they are free of foreign materials and have been ascertained to be adequate for the service intended.

9 INSTALLATION OF PIPING AND VALVES

9.1 Flexible Hose

9.1.1 Installations on which flexible hose is used shall satisfy the following conditions:

a) Cylinder and the appliances connected to it shall be in the same room/shed;

b) Length of hose shall be kept as short as possible and should normally not exceed 2 m; and

c) Appliances connected shall be of portable type and not mounted in a fixed position.

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9.1.2 Flexible hose shall not be extended from one room or verandah or one space to another and, therefore, shall not be passed through doors, windows, walls, partitions, ceilings, or floors.

9.1.3 Flexible hose shall be accessible for easy inspection and shall not be connected from view in walls, cupboards, cabinets and other obstructions.

9.1.4 Flexible hose shall not be used in conditions where ambient temperature exceeds 52°C.

9.1.5 Flexible hose shall be so installed that it is not twisted, looped or kinked and is not subjected to any external pressure. Periodic inspection to be carried out by the supplier of the gas.

9.2 Appliances which are rigidly fixed in position shall be connected by means of rigid piping.

9.3 Appliances which are portable, if connected to rigid piping, shall be connected through flexible or semi flexible connections.

9.4 Cylinder Pigtails

Flexible reinforced synthetic rubber pipes can also be used. The quality of braided synthetic rubber tubes shall be such that it is least affected by LPG. The reinforcement braiding should be able to withstand the same pressure as that of cylinder manifold. The design and test criteria shall be same as that of cylinder manifold. The hydrostatic test pressure shall not be less than 25 kgf/cm^2. The free nut at the end shall be of non-corrosive metal.

9.5 Adaptor

If an adaptor is used to connect the pigtails to the cylinder valves (self-closing) of the LPG cylinders then it shall have non-return device and shall have prior approval of the oil industry.

9.6 Pressure Gauge

A good quality pressure gauge with a range of 0-5 kgf/cm^2 shall be provided in the pipeline after the first stage pressure regulator. The joint at which pressure gauge is fixed shall be thoroughly checked for leakage. Milli bar pressure gauges (0-500 milli-bar) shall be provided in the pipelines after second stage regulation.

9.7 Excess Flow Valve

The excess flow check valve shall be provided on each arm of the manifold to ensure stoppage of LPG supplies in case of heavy leakage/damage to the pipeline in the downstream facilities. The capacity of the excess flow valve shall be 50 percent more than the maximum designed flow rate required through the manifold, etc.

9.8 Piping

9.8.1 Piping shall be free internally and externally of cutting burrs, loose scales, dirt, dust and other foreign matter before the installation is completed.

9.8.2 It is recommended that, where possible, joints should not be placed beneath ground level in inaccessible places, confined places (for example cellars), air or ventilating ducts, space under flooring or lift shafts.

9.8.3 If joints have to be used in piping beneath ground level in inaccessible places or confined places, they shall be welded or brazed to minimize the risk of leakage which may lead to hazardous collection of gas.

9.8.4 Where welded or brazed joints are used, they shall be of adequate mechanical strength, and the material used for welding or brazing shall have a minimum melting point of 540°C.

9.8.5 Joints other than welded or brazed shall be readily accessible.

9.8.6 Piping shall be so located or protected as to avoid extremes of temperature which might give rise to condensation or cracking of the gas.

9.8.7 Provision shall be made to avoid damage to the piping from its expansion, contraction and vibration and by settlement of the building by which it is carried.

9.8.8 Piping shall be protected against corrosive atmospheres and materials.

9.8.9 As far as possible, concealed piping shall be avoided. If concealed piping is used, it shall be protected against inadvertent damage, such as from nails and knocks, by its location, type of material used or sheathing.

9.8.10 Piping shall not be run in or through an air or ventilating duct, chimney, flue or lift shaft.

9.8.11 Piping up to an outside diameter of 12 mm shall be supported at intervals of about 50 cm by means of pipe saddles or clamps in a way to avoid sagging and shifting. For larger diameter pipes, suitable longer supporting intervals may be used.

9.8.12 It is recommended that if the pipes are run along a surface of a structure, the supports should be so designed that the joints are sufficiently clear of the surface to permit the use of tools without damage to the surface.

9.8.13 It is recommended that when installing pipes along a surface of a structure, the installation is done in such a way that moisture is not trapped between the surface and the pipeline.

9.8.14 It is recommended that the piping passing through walls should be protected by a covering sleeve.

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If it is necessary to pack the space between the piping and the sleeve, a moisture-proof material which does not corrode the piping shall be used.

9.8.15 The distance between gas piping and electrical wiring system shall be at least 600 mm and, where necessary; they shall be securely fixed to prevent contact due to movement. The gas piping should run below the electrical wiring.

9.8.16 The distance between the gas piping and steam piping, if running parallel, shall be at least 150 mm. The gas piping should preferably run below the steam piping.

9.9 Suitable line shut-off valves shall be fitted for each appliance or burner.

9.10 A main valve shall be fitted in the piping as near as possible to its point of entry into building with proper sealing arrangement.

9.11 It is recommended that the number of fittings used in an installation should be kept to a minimum in order to reduce the risk of gas leakage. As far as possible, straight lengths of piping should be used. Where there are bends in the pipeline, these should have a radius of at least five times the diameter of the pipe.

9.12 The open ends of piping and fittings (with the exception of terminal taps or valves in regular use) shall always be made gas-tight by means of either an appropriate terminal fitting or a plug, welded or brazed in position. Welding or brazing material shall have a melting point of at least 540°C.

9.13 The distribution pipeline in residential buildings shall always be laid on walls with proper cleat supports/hanged from the roofs with adequate clearance from wall surface so that surface preparation and painting will be easier. The piping shall be anchored to prevent undue strains on connected equipment and shall not be supported by other piping. The spacing of supports in gas piping installations shall not be greater than 1.8 m for 12/15 mm dia pipe, 2.4 m for 20 mm/25 mm dia pipe, 3 m for 40 mm dia pipe and above.

9.14 The pipeline connecting the storage shed to the main installation should preferably be brought overhead without creating any hazard for the people/ vehicles passing through the same. In case of any foreseen hazard the pipeline can be laid underground in a trench filled up with sand of Grading Zone IV as per IS 383 having MS/RCC cover. The underground pipe shall be provided with adequate protection like wrapping coating, etc, for protection against corrosion.

9.15 The single stage pipeline network (down the range of first stage pressure regulator) from the storage shed onward should work at pressure very close to the working pressure of the appliances. Under no circumstances, the pressure of the pipelines should exceed 1.5 kg/cm^2. This should be obtained by double stage regulation of pressure, if necessary.

10 LEAK TESTING

10.1 Before any system of gas piping is finally put into service, it shall be carefully tested to ensure that it is gas-tight. Where any part of the system is to be enclosed or concealed, the test shall precede the work of closing in.

10.2 Naked flames shall never be used for checking gas-tightness of the installations.

10.3 It is recommended that the location of leaks should be detected by the use of soap solution or similar materials.

10.4 Defective pipes or fittings shall be replaced and shall not be repaired *in-situ*.

10.5 Electronic gas leak detectors duly approved by statutory authorities along with control panel for giving audio/visual alarms shall be used for leak detection especially in commercial/industrial installations and in domestic/residential housing complexes where combined capacity of all installations is exceeding 1 000 kg or where reticulated system has been provided.

11 MAINTENANCE

11.1 The distribution company shall design a elaborate work permit format for the maintenance work which shall be used by the service provider for carrying out any maintenance work. It shall be the responsibility of the service provider to make necessary inspection in line with the work permit before commencement of the work.

11.2 The user shall get the inspection of the cylinder manifold, distribution piping, safety system, equipment, valves fittings, auto change over system, gas monitoring system, hydrant hoses, etc, regularly as per the periodicity defined by the Distributing Company. However, minimum periodicity of inspection shall be once a year and the records have to be maintained. The inspection shall include checking the health, performance of all equipment like valves, regulators, auto change over system for proper operation, underground piping, etc. Work permit system developed by the LPG distribution company shall be followed.

11.3 The repair, maintenance of any defective piping, manifold or any other equipment has to be carried out by agencies approved by the LPG distribution company or distributing company itself.

11.4 Pneumatic testing and hydro testing of piping shall be done once in five years by agencies approved by distribution company.

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11.5 All regulators shall be throttled once a year for it's accurate throttled pressure and safe operation.

11.6 The pigtails shall be checked visually every time empty cylinder is replaced.

11.7 Hydro test of pigtails shall be carried out once in two years. The flexible LPG hose shall also be checked once in two years.

11.8 The distribution company shall conduct a safety awareness camp once in year for the consumers particularly for residential and commercial consumers.

11.9 A fire hydrant line shall be provided in the near vicinity of the installation and a hydrant point with hoses to take care of any exigency or emergency situation.

12 INSTRUCTIONS TO CONSUMERS

12.1 Consumers shall be instructed by the distribution company on the following:

a) Operation of the whole system;
b) How to recognize gas leaks;
c) Action to be taken in case of leakage;
d) Action to be taken in case of fire; and
e) Action to be taken in case of damage to, or failure of, any part of the installation.

12.2 Parts or Installation Subjected to Cylinder Pressure

Test pressure of 25 kgf/cm^2 or one and a half times the developed at 65^{o}C, whichever is more.

12.3 Portions of Installation Downstream of Adjustable Regulators

Test pressure of one and a half times the maximum outlet pressure that may be given by an adjustable regulator or 2 kgf/cm^2, whichever is more.

12.4 Test pressure for portions of installation not subjected to cylinder pressure but carrying gas at pressure more than 30 gf/cm^2 —1.5 times the working pressure.

12.5 Portions of installation subjected to gas pressure of 30 gf/cm^2 or less — Test pressure of 150 gf/cm^2.

12.6 Handling and Use

a) Cylinders shall be adequately supported during handling and shall not be dropped or should not be allowed to fall upon one another.
b) Trolleys and cradles of adequate strength shall as far as possible be used when moving the cylinders.
c) Use of high powered magnets for lifting the cylinders and chains for slinging the cylinders shall not be permitted.
d) No lubricant should be used on the valve or any other fitting on the cylinder.
e) Open flames, lights, lighting of fires, welding and smoking shall be prohibited in close proximity.

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ANNEX A
(*Clause* 1.2)

REQUIREMENTS OF LIQUID OFF TAKE VALVE MULTI CYLINDER INSTALLATION

A-1 GENERAL

a) The Liquid withdrawal or liquid off take (LOT) valve multi cylinder installation shall meet the requirements given in IS 6044 (Part 2) and this standard.
b) Total number of cylinders in an installation shall be such that the total quantity of LPG in all cylinders is not more than 1 000 kg. Two such installations can be provided, provided these are separated by a distance of 5 m.
c) The liquid off take valve installation shall be as provided only for Industrial-stationery installation that fulfils safety norms.
d) The cylinder and the valve shall be approved by statutory authority. The valve used for liquid off take shall also be approved by statutory authority separately.
e) For any additional cylinders which are to be kept loose, the customer can store them within stipulations as provided for in *Gas Cylinders Rules*, 2004.
f) The manifold and the LOT valve installation shall be certified by the officer of the distributing company or third party inspection agency approved by distribution company prior to commissioning.

A-2 LAYOUT

a) The site for LPG cylinder manifold shall be located away from the furnace, any source radiating heat like steam pipes and boilers, etc, to prevent cylinders from getting affected due to radiant heat.

b) The area where this installation is provided shall,
   1) be a segregated area with proper house keeping. Growth of grass, etc, in this area shall be avoided.
   2) have proper flooring with shed. The flooring shall be raised by minimum 100 mm from the natural ground. The cylinders shall be stored in dry, cool and well ventilated shed.

c) The cylinder storage area and the area where vaporizer is installed shall be a covered shed with sides open for ventilation. Flammable materials like wood and plastic shall not be stored in this area. FLP light fitting approved by the Statutory Authority for lighting with armoured aluminium/copper PVC extruded cable with fire retardant properties conforming to relevant Indian Standards shall be provided.

d) The cylinder shall be installed in upright position with the valve pointing upwards.

e) The cylinder installation should be so located so as to facilitate the following:
   1) Full and empty cylinders can be easily changed, disconnected and removed quickly at the time of normal operation or emergency.
   2) It is easy to operate and maintain the valve provided between the manifold and the cylinder.
   3) Manifold maintenance is easier.
   4) Cylinders shall not be installed below ground level in cellars or basement or at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety.

f) Since LPG is heavier than air, proper ventilation shall be provided at floor level open to atmosphere.

g) Main shut-off valve (Plug or ball-type) on the pipeline emerging out of cylinder storage shed shall be located in such a manner that it just falls outside the cylinder storage shed and shall be easily accessible at all times. At the point of entry of each work place, the line shall have a quick shut-off valve (plug or ball-type).

h) Wherever the pipelines are passing through walls, slacks shall be provided so that the pipeline does not get abraized.

j) A minimum distance of 1 m shall be maintained between the cylinder installation and the surface water drain, if any.

A-3 INSTALLATION

Following provisions, in addition to requirements given in IS 6044 (Part 2) and this standard are to be made for LOT valve installation:

a) A safety valve, thermal relief valve and excess flow check valve, non-return valve shall be provided on liquid line as shown in Fig. 1. SRVs may be inter-connected through a common vent flow 3 m above thereof.

b) The safety relief valves provided should be of adequate capacity and shall have the approval of statutory authority. The design calculations of safety relief valve provided should be approved by a statutory authority.

c) The vent of the safety valve/thermal relief valve shall be at a height of 3 m from the top of safety valve. It shall be adequately supported. A thermal relief valve is required to be provided between two isolation valves in the liquid pipeline.

d) For all installations minimum two stage regulation shall be provided. The first stage regulation is provided between LPG cylinder manifold and the vapourizer for regulating the flow of liquid LPG as per demand. The second stage regulation shall be provided after the vapourizer as shown in Fig. 1.

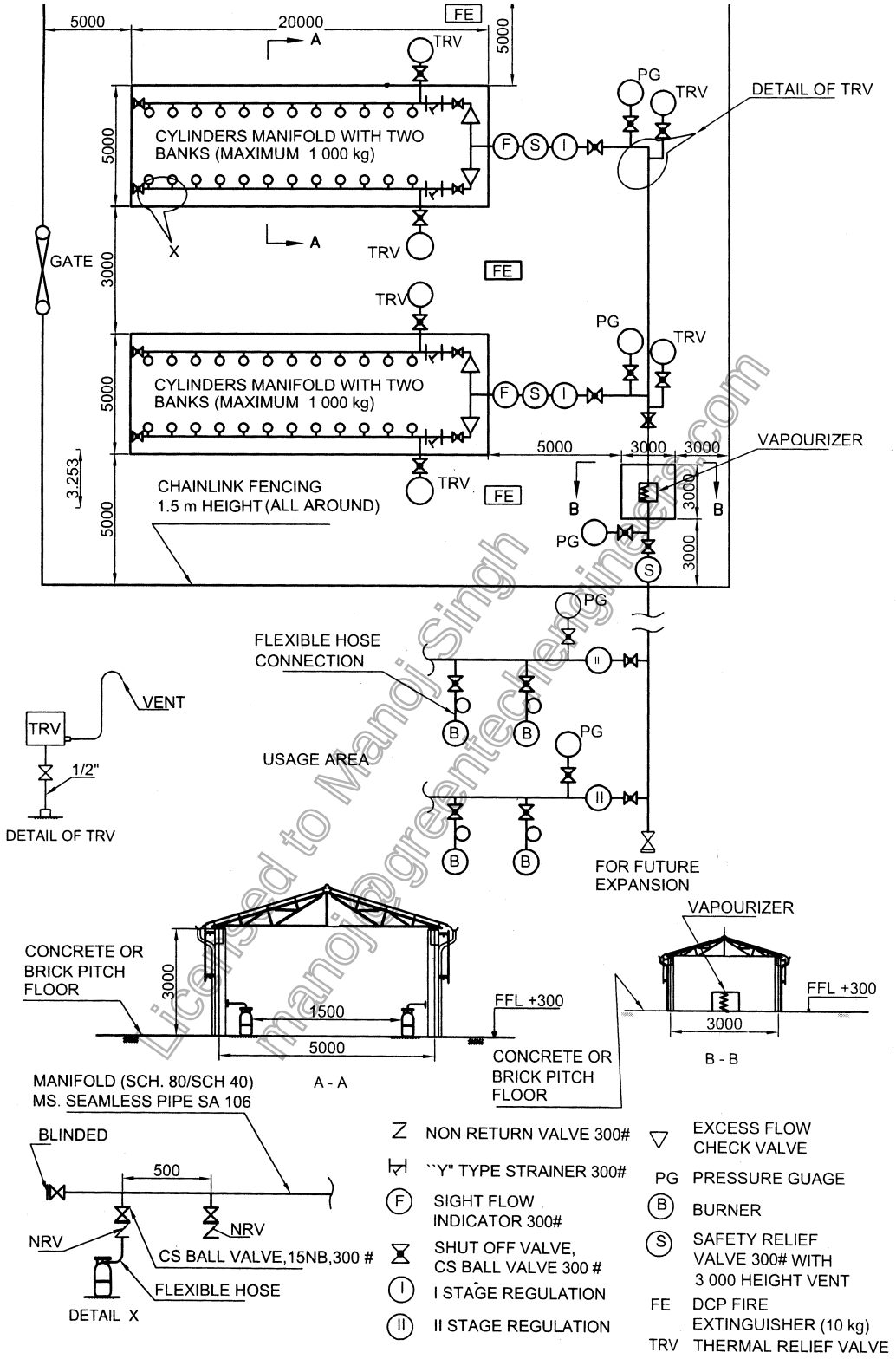
e) The name plate shall be provided on the piping manifold assembly containing the following information:
   1) Name of the owner;
   2) Type of installation;
   3) Installation date;
   4) Date of test and test pressure, in kg/cm^2; and
   5) Manufacturer's identification symbol.

A-4 PIPE AND PIPE FITTINGS FOR PIPING MANIFOLD UP TO STAGE II REGULATION REGULATOR

a) The pipe fittings used shall be forged fittings of SCH 80, as per specifications approved by the distributing company/statutory requirements.

b) All fittings of less than 50 NB shall also be forged fittings of 3 000 class rating.

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NOTES

1 All pipelines 50 NB and above shall be SCH 40 and below 50 NB shall be SCH 80.

2 FLP fittings to be used.

3 NRV to be provided at each cylinder tapping in manifold.

All dimensions in millimetres.

FIG. 1 LPG CYLINDERS DOUBLE MANIFOLD INSTALLATION FOR LIQUID OFF TAKE

c) The pipe used for liquid line that is up to vapourizer and from vaporizer to second. Stage regulation regulator shall be seamless steel pipes as per specifications approved by distribution company/statutory body/local authorities. Pipes of below 50 NB shall be of SCH 80 and pipes of 50 NB and above shall be of SCH 40. Copper tubing manifolds shall not be allowed.

d) No screwed connection shall be allowed. In case due to any reason screwed connection is used, the pipe used shall be of SCH 80 only.

e) The valves, sight flow indicator, thermal relief valve, NRV, etc, shall be of 300 class rating. Only cast steel ball valves with fire safe feature shall be used.

f) All flanges used shall be of carbon steel, SA 105, 300 class rating with dimensional standard as per specifications approved by distribution company/statutory body/local authorities. No screwed connections should be provided.

g) All weld joints provided on the line shall be accessible and shall be hydro-tested for 25 kgf/cm^2 pressure. The welding shall be fusion welding.

h) Only metallic/spiral wound metallic gaskets shall be used for liquid line that is up to vapourizer and also down stream of vapourizer.

j) Each arm of the manifold shall have a control valve. To each arm of the cylinder manifold, cylinders shall be connected through a pigtail. A check valve and a isolation valve shall be provided with each cylinder pigtail connection to protect the system from back flow of LPG in event of any flexible pigtail rupture. The distance between two pigtail connections on manifold shall be minimum 500 mm.

k) Cylinder manifold is subjected to full cylinder pressure at all times. The fabrication/welding of the manifold should be of the best available quality. All such manifolds shall be designed to a pressure equivalent to the maximum possible cylinder pressure (assessed at 65°C) of LPG that is 16.87 kgf/cm^2. The test pressure should be 1.5 times the maximum pressure (assessed at 65°C) that is 25 kgf/cm^2.

m) **Painting** — Piping manifolds and the supporting structure shall be painted with two coats of red oxide primer and with two coats of first quality synthetic enamel paint. The colour of the LPG lines shall be as per IS 2379.

A-5 VAPOURIZER

a) The vapourizer used shall be approved by statutory authorities and shall be as per IS 6044 (Part 2). Vapourizers may be low pressure steam heated, hot water heated, electrically heated type. In case electrical vapourizer is used, it shall have FLP connections. However, direct fired vapourizers are not recommended.

b) A minimum safety distance of 5 m of vapourizer from cylinder installation shall be maintained.

c) The vapourizers shall be provided with suitable automatic means to prevent liquid LPG passing from the vapourizer to gas discharge piping.

d) Vapourizer shall be marked to include details as per **7.2.2** of IS 6044 (Part 2).

e) Vapourizer shall be designed to facilitate testing, inspection and servicing of both LPG and heating units without undue disturbance of the whole vapourizer.

f) Safety relief valve shall be provided on the vapourizer.

A-6 PIPING, TUBING AND FITTINGS AFTER SECOND REGULATION

a) All pipe fittings after second stage regulation shall be in line with **8**.

b) Steel tubes used shall be as per IS 3601 and shall be cold drawn seamless, electric welded, ERW or oxyacetylene welded type.

c) Mild steel tubes used shall be hot finished seamless or electric resistance welded (ERW) type of medium or Heavy section as per IS 1239 (Part 1).

d) No cast iron or aluminium fittings shall be used.

A-7 FLEXIBLE HOSE

a) The hoses connecting cylinder with manifold shall be in line with IS 6044 (Part 2) and shall be used for connecting the cylinder to manifold. The hoses shall be Type 4 as per IS 9573, or as approved by statutory authority. The hoses shall be hydrotetsed at 25 kg/cm^2 pressure once in six months.

b) The design, material and construction of hoses shall be suitable for grade of LPG. Currently, it is envisaged that LPG as per IS 4576 shall be supplied.

c) The flexible hoses should have electrical continuity of 0.75 Ω/m.

d) All flexible hoses used before first stage

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regulation and after second. Stage regulation shall be tested at 3.5 MPa (35 kgf/cm^2) during initial manufacture and should be designed to withstand a minimum bursting pressure of four times the maximum pressure.

e) The flexible hose/pigtail shall be in the same room and its length shall not exceed 2 m. Flexible hose/pigtail shall not pass through doors, windows, walls, ceiling (or) floors. The pigtails shall be accessible for inspection.

f) In case the ambient temperature exceeds 50°C, flexible hose shall not be used.

g) The flexible hose shall not be twisted, looped or kinked. It should not be subject to any external pressure.

h) The hose shall be tested half yearly and proper records of testing, etc, shall be maintained.

A-8 SAFETY AND INSPECTION

a) The consumer has to be trained to use the LOT cylinder installation. A trained personnel who has minimum qualification as Diploma in Engineering shall be responsible for the installation from customer's end.

b) Distributing company shall assist the consumer in organizing regular safety programmes, drills, etc, and will also provide regular training on use of LPG.

c) After empty cylinders shall be placed in a safe place and proper safety cap shall be provided on the valve so as to ensure that no leakage takes place.

A-8.1 Maintenance of Cylinder Manifold

Maintenance of the cylinders manifold and the equipments shall be undertaken regularly and the periodicity of the maintenance shall be as under:

A-8.1.1 *Periodicity of Checks and Maintenance*

a) *Valves*

1) All the valves that is safety valves, TRV shall be checked once a year by a Competent Authority approved by statutory authority.

2) All the other valves should be checked once a year for free and full range of movement, positive shut off, mechanical damage, etc.

b) *Piping and manifold*

1) It should be checked once a year visually for corrosion, any physical damage. All supports of manifold should also be checked for any corrosion, etc.

2) The manifold should be internally cleaned once a year and should be free from contaminants.

3) The strainer provided on the manifold should be cleaned at least once in six months.

4) Hydro testing of manifold and pneumatic testing of pipelines should be done once in 5 years.

c) Vapourizer shall be checked as per maintenance schedule given by the manufacturer and the strainers, etc, should be cleaned at least twice a year.

d) The burners shall be regularly cleaned.

e) Pigtails shall be checked every time empty cylinder is replaced by a filled cylinder and replaced in case of any physical damage.

f) The regulators should be checked once in a year for correct settings and performance as well as for corrosion and mechanical damage.

g) The pressure gauges should be calibrated once in a year and proper records should be maintained. The dial of the gauge should be clearly visible.

A-8.2 Inspection

a) All the manifold installations shall be checked once in six months by the Approved Agency or the LPG distributing company and record maintained at the installation location.

b) The installation shall be checked once in a year by the Sales Officer of the Gas Supplying Company or by their authorized Third Party Inspection Agency.

c) The area of LOT installation should be free of any uncontrolled weed growth and accumulation of waste products.

d) Regulator settings should be checked as per norms given in **8.1.1** (f).

A-8.3 Leak Testing

a) It shall be ensured that the manifold provided has been subjected to the hydro test pressure of 25.35 kgf/cm^2 at least for a minimum period of 30 min and inspected by the approved agency or the distribution company.

b) It shall be ensured that the fire extinguishers and sand buckets are provided and installations are adequately protected from weather conditions.

c) The gas piping system should be carefully tested for ensuring gas tightness.

d) Naked flames shall never be used for checking gas tightness of the installation.

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e) Leak detection should be done using soap solution or similar material.

f) All defective pipes should be replaced and no repair should be carried out *in-situ*.

A-8.4 Warning Signals

a) Smoking or naked flames shall not be permitted within the Safety Zones of the installation. 'NO SMOKING', 'HIGHLY INFLAMMABLE GAS', 'DANGER', boards shall be provided.

b) Sign boards, instruction boards for 'DOs' and 'DONTs' shall be provided.

c) Instruction board with emergency telephone numbers and important telephone numbers shall be provided.

d) Instruction board prohibiting unauthorized entry shall be provided.

e) It shall be ensured that all signage are in place and are legible.

A-8.5 Source of Leakages

a) *Cylinders*:
   1) Welded seams;
   2) The cylinder/valve connection bung joint; and
   3) Cylinder valve.

b) *Check Leakage from Pressure Regulator at:*
   1) Near the joints;
   2) In the pressure regulator itself;
   3) Check leakage from the piping and manifold regulator and the appliance inlet nozzle;
   4) Check leakage from cooking appliances at,
      i) all threaded connections; and
      ii) the appliances itself.

A-8.6 Action to be Taken when Leakage is Detected

a) *Leakage of Cylinder* — Any cylinder which develops a leak should be promptly removed to an isolated open place away from any source of ignition.

b) In case of leakages of piping, appliances or pressure regulators, close the valves and isolate the part, disconnect the cylinders and place the safety cap on the valve of the cylinder. Never repair the appliance or any other part of system when in use.

c) The matter should be immediately reported to the In-charge and the officer of gas supply company.

A-9 EARTHING AND ELECTRICAL PROTECTION

a) The cylinder manifold installation, the vapourizer installation and the down stream installation shall be earthed at two places. Two earth pits as per IS 3043 shall be provided and the earthing resistance should not exceed 1 Ω.

b) The system should be tested for electrical continuity and resistance to earth.

c) The earthing resistance shall be checked twice a year once during the summer season and once during winter and records for same shall be maintained.

d) Only flame proof electrical fittings approved by statutory authorities shall be used in the area segregated for LOT installation**.** These shall be earthed at two points.

e) Only flame proof hand torches shall be used.

f) Copper jumpers shall be provided at flange joints in manifold for electric continuity.

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ANNEX B
(*Foreword*)

COMMITTEE COMPOSITION

Gas Cylinders Sectional Committee, MED 16

Organization	*Representative(s)*
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